JOURNAL OF ADVANCEMENT IN ENGINEERING AND TECHNOLOGY
Journal homepage: http://scienceq.org/Journals/JAET.php

Research Article Open Access

Web Enabled Remote Weather Monitoring Station Using ARM Microcontroller

E.Mallikarjuna
Assistant Professor in Department of ECE, TEC Engineering College Tadipatri, AP. India.
*Corresponding author: E.mail : mallikarjuna.en@gmail.com

Received: July15, 2015, Accepted: September 25, 2015, Published: September 25, 2015

ABSTRACT

Web browsers have become the defactostandard user interface to variety of applications. They can run on almost any platform – from PCs and workstations to PDAs, cell phones, and pagers – and allow end-users to access Web-enabled applications from any location. Applied to embedded systems, Web technologies offer graphical user interfaces that are user friendly, inexpensive, cross-platform, and network-ready. System designers are therefore using them to supplement or replace traditional proprietary command-line and graphical user interfaces.Web interfaces offer benefits to manufacturers as well as to end-users. Because Web-based interfaces are cross-platform and easier to develop than traditional proprietary interfaces, manufacturers enjoy a shorter time-to-market for new product support, training and documentation is lower, and the Web interface can be used for remote diagnostics of products in the field.In this project a cost effective, user friendly and robust system is developed for monitoring of weather parameters like temperature and humidity. The system continuously monitors the temperature and humidity. The end user can see the information from anywhere through internet. The heart of the system consists of LPC2148 ARM7 32- bit microcontroller with ENC28J60 Ethernet interface. This module is used for web connectivity and controlling the field hardware. LM35 a precision centigrade calibrated temperature to voltage sensor is used to measure the temperature gives an analog voltage and HIH-4000series sensors are used for the measure of humidity gives an analog voltage. These two voltages are fed to ADC of ARM microcontroller. The readings thus obtained are displayed on LCD display. Along with it we can monitor the temperature with web interface.

Keyword: Microcontroller, LCD, LED, ADC, PCB

INTRODUCTION

A web-enabled system is an application, originally written for the client/server or mainframe environment, which has been rewritten to be accessed through a Web browser. Typically, this is accomplished by adding a new layer to the existing software. The original system that runs underneath is performing the same functions as before, but the program input and output is being translated into HTML, the language understood by a Web browser. The extra step slows down the process while adding expense and complexity.Information on day-to-day changes in temperature, precipitation, wind speed, and other variables, or weather, are important for Human life. Today, the winds and other weather variables are of equal concern and can have an even greater impact on our modern, high-tech life style. Weather affects a wide range of man's activities, including agriculture, transportation and leisure time. Often the affects involve the movement of gases and particulates through the atmosphere.Climate influences the distribution of plants and animals, snowpack and stream flow dynamics, and fire regimes. Weather and climate information can be used to help interpret changes in other resources and processes that are monitored (such as stream and wetland water dynamics, wetlands vegetation and invertebrates, and bird populations).The behavior of wildfires is affected by variation in daily weather. Hence weather monitoring is very important in our daily life.

BLOCK DIAGRAM:

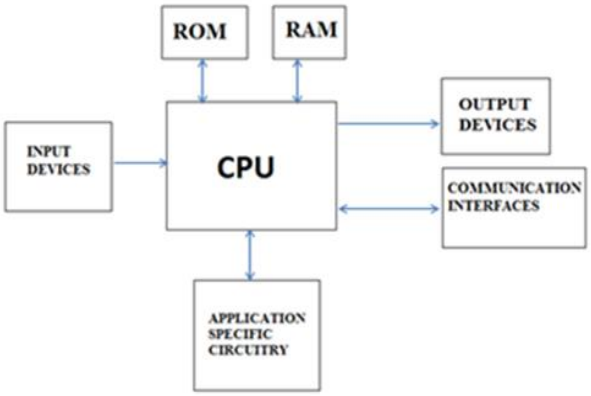

Fig.1 Block Diagram of web enabled remote weather monitoring station using arm microcontroller

Hardware Tools:

- A PC available with RS232 port for ISP programming
- Parallel Port for JTAG programming &Debugging
- DC Adapter
- Ethernet Interface Module
- ARM Microcontroller

In telecommunication, RS-232(Recommended Standard 232) is the traditional name for a series of standards for serial binary Single-ended data and Control signals connecting between a DTE(Data Terminal Equipment) and a DCE(Data

Circuit-terminal Equipment). It is commonly used in Computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pin out of connectors. An RS-232 port was once a standard feature of a Personal Computer for connections to Modems, Printers, Mice, data storage, un-interruptible power supplies, and other peripheral devices. However, the limited transmission speed, relatively large voltage swing, and large standard connectors motivated development of the Universal Serial Bus (USB) which has displaced RS-232 from most of its peripheral interface roles. Many modern personal computers have no RS-232 ports and must use an external converter to connect to older peripherals. Some RS-232 devices are still found especially in industrial machines or scientific instruments.Joint Test Action Group (JTAG) is the common name for what was later standardized as the IEEE 1149.1 Standard Test Access Port and Boundary-Scan Architecture. It was initially devised for testing printed circuit boards using boundary scan and is still widely used for this application.Today JTAG is also widely used for IC debug reports. In the embedded processor market, essentially all modern processors support JTAG when they have enough pins. Embedded Systems development relies on debuggers talking to chips with JTAG to perform operations like single stepping and breaking point. Digital electronics products such as cell phones or a wireless Access Point generally have no other debug or test interfaces.Originally, most AC to DC adapters were linear power supplies, containing a transformer to convert the mains electricity voltage to a lower voltage, a rectifier to convert it to pulsating DC, and a filter to smooth the pulsating waveform to DC, with residual ripple variations small enough not to affect the device being powered. Size and weight of the device was largely determined by the transformer, which in turn was determined by the power output and mains frequency. Ratings over a few watts made the devices too large and heavy to be physically supported by a wall outlet. The output voltage of these adapters varied with load; for equipment requiring a more stable voltage, linear voltage regulator circuitry was added. Losses in the transformer and the linear regulator were considerable; efficiency was relatively low, and significant power dissipated as heat even when not driving a load.Ethernet is the most widely-installed local area network (LAN) technology. Specified in a standard, IEEE 802.3, Ethernet was originally developed by Xerox from an earlier specification called Alohanet (for the Palo Alto Research Center Aloha network) and then developed further by Xerox, DEC, and Intel. An Ethernet LAN typically uses coaxial cable or special grades of twisted pair wires. Ethernet is also used in wirelessLAN's. The most commonly installed Ethernet systems are called 10BASE-T and provide transmission speeds up to 10Mbps. Devices are connected to the cable and compete for access using a Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.An Embedded System is a single-purpose computer built into a larger system for the purposes of controlling and monitoring the system. That is it a specialized computer system that is a part of a larger system or machine. The special computers system is usually less powerful than general-purpose systems, although some expectations do exist where embedded systems are very powerful and complicated.Embedded systems contain processing cores that are typically either microcontroller or Digital Signal Processing (DSP). The embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from Economies of scale.Web servers are computers that deliver (*serves up*) Web pages. Every Web server has an IP address and possibly a domain name. For example, if you enter the URL *http://www.pcwebopedia.com/index.html* in your browser, this sends a request to the Web server whose domain name is *pcwebopedia.com*. The server then fetches the page named *index.html* and sends it to your browser.Any computer can be turned into a Web server by installing server software and connecting the machine to the Internet. There are many Web server software applications, including public domain software from NCSA and Apache, and commercial packages from Microsoft, Netscape and others.**Web server** can refer to either the hardware (the computer) or the software (the computer application) that helps to deliver content that can be accessed through the Internet.The most common use of web servers is to host websites but there are other uses such as data storage or running Enterprise applications. In 1989 Tim Berners-Lee proposed a new project with the goal of easing the exchange of information between scientists by using a hypertext system to his employer CERN. The project resulted in Berners-Lee writing two programs in 1990:Between 1991 and 1994, the simplicity and effectiveness of early technologies used to surf and exchange data through the World Wide Web helped to port them to many different operating systems and spread their use among diverse organizations.

I. The Basic Process

Fig. 2 Basic process of web server

Let's say that you are sitting at your computer, surfing the Web, and you get a call from a friend who says, "I just read a great article! Type in this URL and check it out. It's at http://www.howstuffworks.com/web-server.htm." So you type that URL into your browser and press return. And magically, no matter where in the world that URL lives, the page pops up on your screen.If you want to get into a bit more detail on the process of getting a Web page onto your computer screen, here are the basic steps that occurred behind the scenes:The browser communicated with a name server to translate the server name "www.howstuffworks.com" into an **IP Address**, which it uses to connect to the server machine. The browser then formed a connection to the server at that IP address on port 80. Following the HTTP protocol, the browser sent a GET request to the server, asking for the file "http://www.howstuffworks.com/web-server.htm." The server then sent the HTML text for the Web page to the browser. (Cookies may also be sent from server to browser in the header for the page.) The browser read the HTML tags and formatted the page onto your screen.If you've never explored this process before, that's a lot of new vocabulary. To understand this whole process in detail, you need to learn about IP addresses, ports, protocols... The following sections will lead you through a complete explanation.Fast Ethernet or 100BASE-T provides transmission speeds up to 100 megabits per second and is typically

used for LAN backbone systems, supporting workstations with 10BASE-T cards. Gigabit Ethernet provides an even higher level of backbone support at 1000 megabits per second (1 gigabit or 1 billion bits per second). 10-Gigabit Ethernet provides up to 10 billion bits per second.Ethernet was named by Robert Metcalfe, one of its developers, for the passive substance called "luminiferous (light-transmitting) ether" that was once thought to pervade the universe, carrying light throughout. Ethernet was so-named to describe the way that cabling, also a passive medium could similarly carry data everywhere throughout the network.

Software Tools

- Kiel uV3 or WINARM for Programming
- H-JTAG or Phillips Flash Utility for Flash Programming.
- MS Windows 98/ME or windows WT/2000/2003/Xp
- TCP/IP Protocol.

µVision3 is an IDE (*Integrated Development Environment*) that helps you write, compile, and debug embedded programs. It encapsulates the following components: **Windows XP** is an Operating system produced by Microsoft for use on Personal Computers, including home and business desktops, Laptops and media centers. Windows XP featured a new task-based GUI (*Graphical user interface*). Transmission Control Protocol/Internet Protocol (TCP/IP) is an industry standard suite of protocols that is designed for large networks consisting of network segments that are connected by routers. TCP/IP is the protocol that is used on the Internet, which is the collection of thousands of networks worldwide that connect research facilities, universities, libraries, government agencies, private companies, and individuals.The roots of TCP/IP can be traced back to research conducted by the United States Department of Defense (DOD) Advanced Research Projects Agency (DARPA) in the late 1960s and early 1970s.

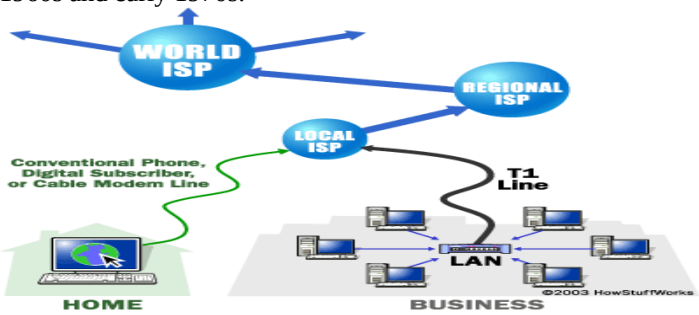

Fig.3 Schematic Diagram of Internet

So what is "the Internet"? The Internet is a gigantic collection of millions of computers, all linked together on a **computer network**. The network allows all of the computers to communicate with one another. A home computer may be linked to the Internet using a phone-line modem, DSL or cable modem that talks to an Internet service provider (**ISP**). A computer in a business or university will usually have a network interface card (**NIC**) that directly connects it to a local area network (**LAN**) inside the business. The business can then connect its LAN to an ISP using a high-speed phone line like a **T1 line**. A T1 line can handle approximately 1.5 million bits per second, while a normal phone line using a modem can typically handle 30,000 to 50,000 bits per second.

EXECUTION PROCEDURE: Here in the software description, Keil and Flash magic softwares play an important role in coding. Keil is the software used for checking out the errors in the program. It is used for the debugging and compilation process. The detection of any error is called Debugging. The conversion tool used for the conversion of assembly level language into machine level language is known as Assembler. The process of transformation of Source code from source address to destination address is called Compilation. The transportation tool is Compiler. Software supports the hardware in order to complete the given task. If the software is somewhere gone wrong, then the hardware works on it and gives abrupt results. This may lead to wrong calculation of the entire circuit. Some errors may be in a way that even the debugger can't detect them. So continuous monitoring is required.Flash magic uploader is software which is used for the purpose of uploading a program into the microcontroller. This is very much essential for the circuit to be worked out. It makes to provide interface between various peripherals and the microcontroller.The above picture is a screenshot of the main Flash Magic window. The appearance may differ slightly depending on the device selected.There are five menus, File, ISP, Options, Tools and Help.The File menu provides access to loading and saving Hex Files, loading and saving settings files and exiting the application.The ISP menu provides access to the less commonly used ISP features.

FLOW CHART OF EXECUTION PROCEDURE:

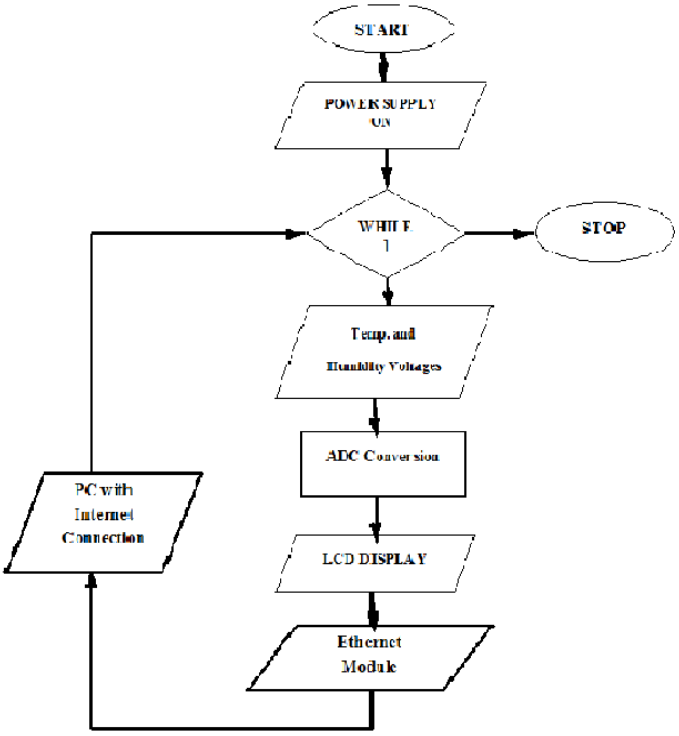

Fig.4 Flow chart of Web Enabled Remote Weather Monitoring Station

OBSERVATIONS:

Fig. 5 Web Enabled Remote Weather Monitoring System When it is plug-in

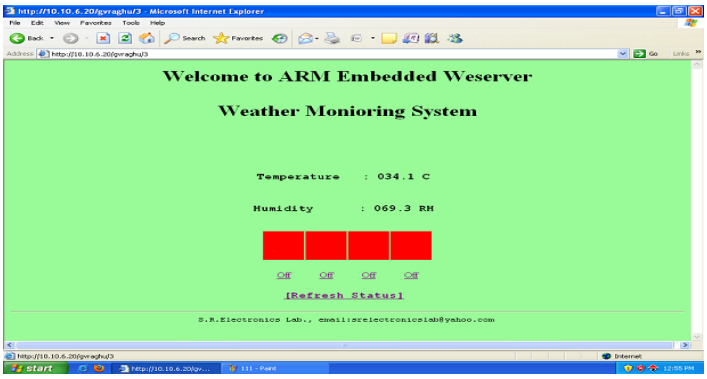

Fig.6 Display of the Temperature and Humidity on the computer desktop

Working Procedure

1. Connect all the external peripherals to the microcontroller as shown in the schematic diagram.
2. Switch ON the power supply.
3. The Sensors are properly placed to monitor the weather conditions.
4. The remaining work will be done by the controller itself of monitoring the weather conditions.
5. The Ethernet Interface Module is used to transfer the data in the form of bits to the Internet.
6. We can monitor the temperature and humidity levels across the globe using Internet.
7. In order to see these readings we just want to type the Internet address as http://10.10.6.2/gvraghu.

CONCLUSION:

We can measure the weather conditions of a particular region by staying in another region itself using Internet through this system. This system is very much useful in Factories, Nuclear reaction centers, etc, places in order to monitor the humidity and temperature time-to-time. This system continuously monitors the temperature and Humidity until the power supply is ON.

REFERENCES

1. KVKK.Prasad, “Embedded/Real Time Systems”, Dreamtech Press, 2nd Edition, 2005
2. “ARM Processor Instruction Set Architecture”.Arm.com. Retrieved 2009-04-18.
3. Balmat, J. and D.K. Scott. 2010. Weather data inventory, Devils Postpile National Monument. Natural Resource Report NPS/SIEN/NRDS—2010/113. National Park Service, Fort Collins, Colorado.
4. "What is web server?"'. Webdevelopersnotes. 2010-11-23. Retrieved 2010-11-23.
5. www.wikipedia.org
6. www.honeywell.com
7. www.fairchidsemi.com
8. www.howstuffworks.com
9. www.maxim-ic.com
10. www.nskelectronics.com

Citation: E.Mallikarjuna. Web Enabled Remote Weather Monitoring Station Using ARM Microcontroller. J. of Advancement in Engineering and Technology. V3I3. DOI: 10.15297/JAET.V3I3.08